Kimley»Horn

January 27, 2020

Town of Chapel Hill
405 Martin Luther King Jr Boulevard
Chapel Hill, NC 27514

Subject: ***Fordham Boulevard Noise Monitoring for STIP Project EB-5721***

At the request of the Town of Chapel Hill, Kimley-Horn conducted ambient noise monitoring on both sides of Fordham Boulevard (US 15-501) in the area surrounding STIP Project EB-5721, which proposes to construct a 10-foot-wide multi-use path along Fordham Boulevard from Cleland Drive to Willow Drive. The following memorandum has been prepared to document the existing sound levels measured in the vicinity of the residential area adjacent to the proposed project.

Characteristics of Noise

Noise is generally defined as unwanted sound. It is emitted from many natural and man-made sources. The degree of disturbance or annoyance from exposure to unwanted sound – noise – depends upon three factors:

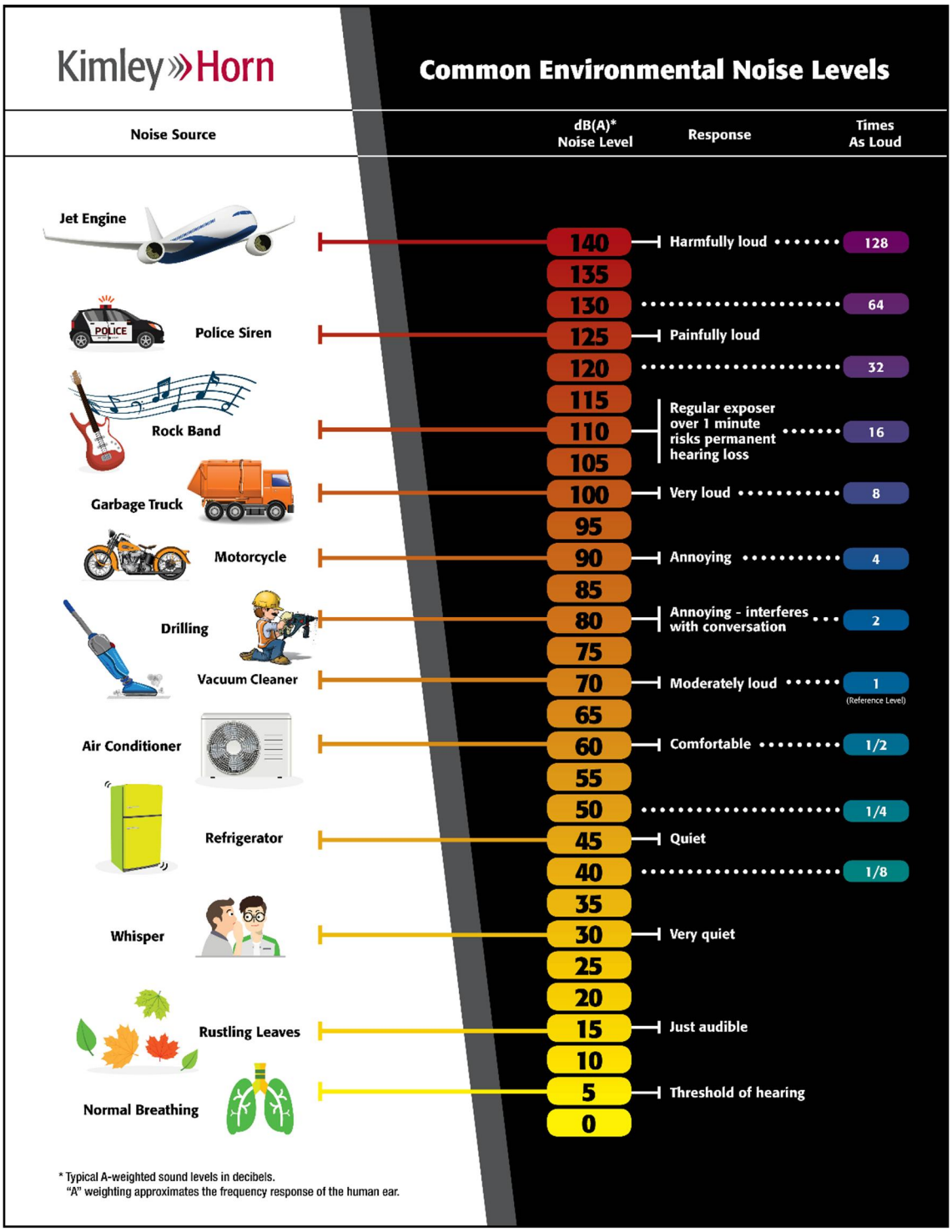
1. The amount, nature, and duration of the intruding noise
2. The relationship between the intruding noise and the existing sound environment; and
3. The situation in which the disturbing noise is heard

Over time, individuals tend to accept the noises that intrude into their lives on a regular basis. However, exposure to prolonged and/or extremely loud noise(s) can prevent use of exterior and interior spaces and has been theorized to pose health risks.

Sound pressure levels are usually measured and expressed in decibels (dB). The decibel scale is logarithmic and expresses the ratio of the sound pressure unit being measured to a standard reference level. Most sounds occurring in the environment do not consist of a single frequency, but rather a broad band of differing frequencies. The intensities of each frequency add together to generate sound. Because the human ear does not respond to all frequencies equally, the method commonly used to quantify environmental noise consists of evaluating all of the frequencies of a sound according to a weighting system. It has been found that the A-weighted filter on a sound level meter, which includes circuits to differentially measure selected audible frequencies, best approximates the frequency response of the human ear.

As shown in **Figure 1**, most individuals are exposed to fairly high noise levels from many sources on a regular basis. In order to perceive sounds of greatly varying pressure levels, human hearing has a non-linear sensitivity to sound pressure exposure. For example, doubling the sound pressure results in a three decibel change in the noise level; however, variations of three decibels [3 dB(A)] or less are commonly considered “barely perceptible” to normal human hearing. A five decibel [5 dB(A)] change is more readily noticeable. A ten-fold increase in the sound pressure level correlates to a 10 decibel [10 dB(A)] noise level increase; however, it is judged by most people as only a doubling of the loudness – sounding “twice as loud”.

Figure 1: Common Noise Levels



Ambient Noise Monitoring

Kimley-Horn staff conducted noise monitoring from January 16, 2020 to January 17, 2020 in order to document the existing noise levels on either side of Fordham Boulevard in the vicinity of the residences located along Hickory Drive. Noise measurements were collected with two Larson Davis LxT Type I Precision Integrating Sound Level Meters. Measurements were taken using the A-weighted scale and were reported in decibels [dB(A)]. Data collected by the noise meters included time, average noise level (L_{eq}), maximum noise level (L_{max}), and instantaneous peak noise level (L_{pk}) for each interval. The L_{eq} is the equivalent steady-state noise level for the measurement period, and the L_{max} is the loudest observed noise level during the measurement period.

Noise measurements of 24 hours were obtained at two locations near the proposed EB-5721 multi-use path. Noise sources in the area are generally composed of environmental noise (birds, insects, wind in trees, etc.) during the late evening/early morning hours and noise generated from Fordham Boulevard during daytime hours. **Table 1** summarizes the noise levels obtained from the long-term measurements, and the locations are shown in **Figure 2**.

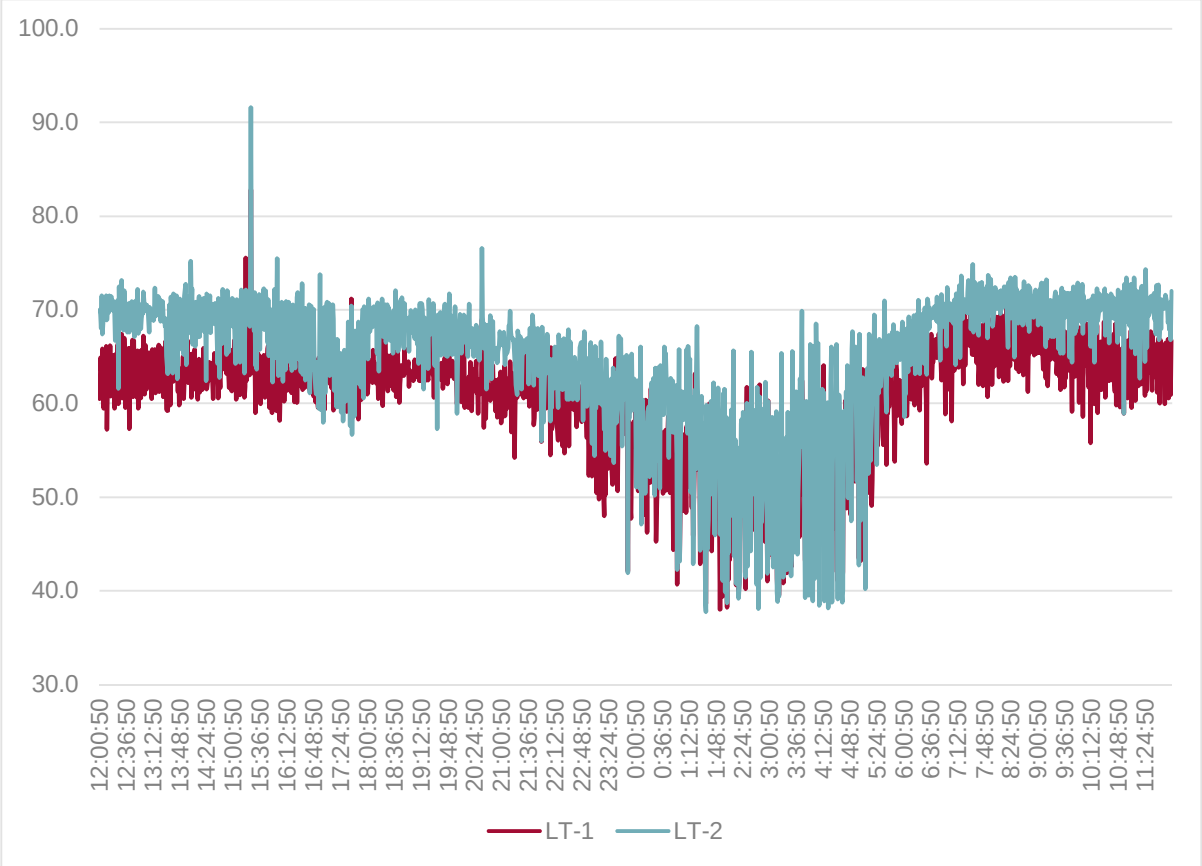
Table 1. Long-Term Noise Measurement Summary

Setup (ML)	Monitored 24-hr Average Sound Level [Leq, dB(A)]	Maximum One-Minute Interval Monitored Sound Level [Leq, dB(A)]
LT 1	63.4	82.8
LT 2	68.6	91.6

Figure 2: Noise Measurement Locations

To help determine what source corresponded to specific noise levels, sound recorders were synced to each of the noise meters. Kimley-Horn used these recordings, as well as field observations, to identify a sampling of noise sources. During the daytime hours, the noise levels at the measurement locations were observed to be generally composed of traffic-related noise including engine exhaust, drive train, and tire-roadway interaction. Occasionally, the siren of an emergency services vehicle was noted, which corresponds to the maximum monitored sound level shown in **Table 1**. The minute-to-minute fluctuations in noise levels recorded at measurement location LT 2 are shown in **Chart 1**.

Chart 1: One-minute Interval Leq Values at LT 1 and LT 2



As displayed in the chart, sound levels vary throughout the day with occasional peaks during the daytime hours due to sirens from emergency services vehicles. Although both measurement locations were the same distance from the edge of Fordham Boulevard, the noise levels monitored at LT-2 were generally higher. The difference in noise levels was likely due to the directional split in traffic volumes on Fordham Boulevard (i.e., more traffic in the northbound direction) as well as the topography on either side of the road. While LT-1 was located at approximately the same elevation as Fordham Boulevard, LT-2 was located approximately 5 feet higher than Fordham Boulevard. This difference in elevation provided a more direct line-of-sight to LT-2, which caused the monitored noise levels to generally be higher than the monitored levels at LT-1.

Noise Abatement Measures

Passive noise abatement measures are effective because they absorb sound energy, extend the source-to-receptor sound transmission path, or both. Sound absorption is a function of abatement medium (e.g. earth berms absorb more sound energy than noise walls of the same height because earth berms are more massive). The source-to-receptor path is extended by placement of an

obstacle, such as an earth berm or concrete wall, that sufficiently blocks the transmission of sound waves that travel from the source to the receptor.

Sound barriers are primarily constructed as earth berms or solid-mass walls adjacent to sources of noise that are in proximity to noise-sensitive land use(s). To be effective, a sound barrier must be long enough and tall enough to shield potentially impacted areas. Generally, the noise barrier length must be eight times the distance from the barrier to the receptor. For example, if a receptor is 200 feet from the noise source, an effective barrier would be approximately 1,600 feet long – with the noise-sensitive land use in the horizontal center.

Since the property lines of the residences located along Hickory Drive are relatively close to Fordham Boulevard (~50 feet), constructing an earthen berm is not feasible due to the lack of available right-of-way. Alternatively, a noise wall does not require as much room to construct, so including one in the design of STIP Project EB-5721 may be more feasible. In order to construct a potential noise wall, the existing vegetation east of Fordham Boulevard would likely need to be cleared, which has caused concern for the residences located along Hickory Drive.

According to the Federal Highway Administration (FHWA), vegetation has the potential to decrease traffic noise if it is high enough, wide enough, and dense enough that it cannot be seen through. For example, a 200-foot wide strip of dense vegetation can reduce noise levels by approximately 10 decibels, which cuts in half the loudness of traffic noise. It is usually impossible, however, to plant enough vegetation along a road to achieve such reductions. For comparison, the vegetation between Fordham Boulevard and the adjacent residences is nearly 35-feet wide and can be seen through. Therefore, the existing vegetation's ability to reduce traffic noise from Fordham Boulevard is low.

On the other hand, roadside landscaping may be planted to create a psychological relief. Since a substantial noise reduction cannot be obtained for an extended period of time, the planting of vegetation is not considered to be a form of noise mitigation by the FHWA and North Carolina Department of Transportation. The planting of trees and shrubs only offers psychological benefits and may be provided for visual, privacy, or aesthetic treatment, not noise abatement.

Recommendations

While noise from Fordham Boulevard cannot be eliminated completely, it is anticipated that constructing a 1,700-foot-long privacy fence with noise absorptive treatments, such as Acoustifence, can be implemented along the property line adjacent to the proposed multi-use path to assist in reducing potential noise related issues for the residences located along Hickory Drive.